

CLAIMS

What is claimed is:

1. A charge pump circuit comprising:
charge pumping capacitance;
5 switches that vary voltage across the pumping capacitance to provide a pumped voltage output from an input voltage;
variable resistance; and
control that varies the variable resistance with varied input voltage.
- 10 2. A charge pump as claimed in claim 1 wherein the variable resistance is coupled in series with the pumping capacitance and input voltage.
3. A charge pump as claimed in claim 1 wherein the variable resistance comprises a switch coupled in parallel with a resistor.
- 15 4. A charge pump as claimed in claim 3 wherein the switch is a field effect transistor.
5. A charge pump as claimed in claim 3 wherein the control comprises a
20 comparator.
6. A charge pump as claimed in claim 3 wherein the control comprises an amplifier.
- 25 7. A charge pump as claimed in claim 3 wherein the control comprises a shunt reference device.
8. A charge pump as claimed in claim 1 wherein the variable resistance
30 comprises a field effect transistor.

9. A charge pump as claimed in claim 1 wherein the control comprises a comparator.
10. A charge pump as claimed in claim 1 wherein the control comprises an amplifier.
11. A charge pump as claimed in claim 1 wherein the control comprises a shunt reference device.
12. A gate controller comprising:
charge pumping capacitance;
switches that vary voltage across the pumping capacitance to provide a pumped gate control voltage from an input voltage;
variable resistance; and
control that varies the variable resistance with varied input voltage.
13. A gate controller as claimed in claim 12 comprising both an internal on chip charge pump and an external charge pump.
14. A gate controller as claimed in claim 12 wherein the variable resistance is coupled in series with the pumping capacitance and input voltage.
15. A gate controller as claimed in claim 12 wherein the variable resistance comprises a switch coupled in parallel with a resistor.
16. A gate controller as claimed in claim 15 wherein the switch is a field effect transistor.
17. A gate controller as claimed in claim 15 wherein the control comprises a comparator.

18. A gate controller as claimed in claim 15 wherein the control comprises an amplifier.
- 5 19. A gate controller as claimed in claim 15 wherein the control comprises a shunt reference device.
20. A gate controller as claimed in claim 12 wherein the variable resistance comprises a field effect transistor.
- 10 21. A gate controller as claimed in claim 12 wherein the control comprises a comparator.
22. A gate controller as claimed in claim 12 wherein the control comprises an amplifier.
- 15 23. A gate controller as claimed in claim 12 wherein the control comprises a shunt reference device.
- 20 24. A DC/DC converter having controlled switches comprising:
charge pumping capacitance;
switches that vary voltage from input voltage across the pumping capacitance to provide a pumped gate control voltage to the controlled switches;
variable resistance; and
25 control that varies the variable resistance with varied input voltage.
25. A DC/DC converter as claimed in claim 24 comprising both an internal on chip charge pump and an external charge pump.

26. A DC/DC converter as claimed in claim 24 wherein the variable resistance is coupled in series with the pumping capacitance and input voltage.
- 5 27. A DC/DC converter as claimed in claim 24 wherein the variable resistance comprises a switch coupled in parallel with a resistor.
28. A DC/DC converter as claimed in claim 27 wherein the switch is a field effect transistor.
- 10 29. A DC/DC converter as claimed in claim 27 wherein the control comprises a comparator.
30. A DC/DC converter as claimed in claim 27 wherein the control comprises an amplifier.
- 15 31. A DC/DC converter as claimed in claim 27 wherein the control comprises a shunt reference device.
32. A DC/DC converter as claimed in claim 24 wherein the variable resistance comprises a field effect transistor.
- 20 33. A DC/DC converter as claimed in claim 24 wherein the control comprises a comparator.
- 25 34. A DC/DC converter as claimed in claim 24 wherein the control comprises an amplifier.
35. A DC/DC converter as claimed in claim 24 wherein the control comprises an shunt reference device.